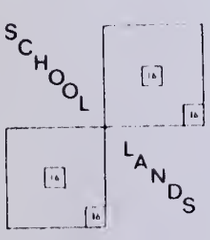
STATE OF MONTANA

DEPARTMENT OF STATE LANDS

STATE CAPITOL HELENA 59601 (406) 449-2074



November 10, 1975

Westmoreland Resources' Sarpy Creek Mine is located in Big Horn County, Montana. Initial mining of coal at this site began on March 26, 1974.

Attached is a Preliminary Environmental Review (P.E.R.) for the proposed approval of an amendment to Westmorelands' 1975 mining permit. This review assesses the updated information and changes submitted by Westmoreland since the distribution of the Department of State Lands' addendum to the final environmental impact statement for the Sarpy Creek Mine. The addendum to the final departmental impact statement was issued on January 17, 1975; the final departmental impact statement was distributed on January 29, 1974.

The outline used in compiling this P.E.R. is contained in the proposed rules implementing the Montana Environmental Policy Act (Chapter 65, Title 69 R.C.M. 1947). These rules have been adopted and approved by the Montana Council on Environmental Quality.

This review indicates that the issuance of the amended permit to Westmoreland does not constitute an action which might significantly affect the quality of the human environment and therefore a draft environmental impact statement will not be issued by the Department. This document is being distributed for informational purposes only. The amendment for Westmorelands' 1975 mining permit is scheduled to be issued in two to three weeks.

All materials submitted to the Department by Westmoreland Resources as part of their application for a permit pursuant to the requirements of the Montana Strip Mining and Reclamation Act (Chapter 10, Title 50, R.C.M. 1947) are on file and available for public review in the Department's offices in Helena.

Sincerely,

Brace Hayden

BRACE HAYDEN
Environmental Coordinator

BH:pc

PRELIMINARY ENVIRONMENTAL REVIEW

Proposed Approval of an Amendment to Westmoreland Resources 1975 Mining Permit

Submitted Pursuant to the Montana Environmental Policy Act Section 69-6504(b)(3) R.C.M. 1947

Prepared by

Montana Department of State Lands

Helena, Montana

November 10, 1975

1. Introduction

On May 21, 1975, Westmoreland Resources submitted an amendment to the second year mining permit for their Sarpy Creek Mine. Westmoreland is seeking approval to mine an additional 255 acres of coal, approval for topsoil storage and associated mining disturbance of 282 acres, and approval of additional roads affecting 33 acres. A fourth portion of this amendment, the construction of an alternate power line affecting 20 acres was approved by the Department on July 15, 1975.

Because of the June 19, 1975, Ninth Circuit, U.S. Court of Appeals' decision of Cady vs. Morton, Westmoreland is unable to mine in accordance with the mining plan submitted with the amendment application. Operations instead must be confined to the area previously approved by the U.S. Geological Survey until such time as the federal impact statement required by Cady vs. Morton has been written.[1] The Department of the Interior is now preparing the required environmental impact statement with a target date of June 30, 1976 for completion.

Because of the Cady vs. Morton decision, Westmoreland, on July 30, 1975, submitted an alternate mining plan for the amendment to their second year mining permit. This alternate plan shows how the company will mine between the time the amendment is approved and the time the Cady vs. Morton mandate is satisfied. The alternate mining plan also shows how mining will proceed after federal approval is given.

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1. Cady vs. Morton directed the District Court (Billings) to issue an order enjoining all future operations under Westmoreland Resources' leases from the Crow Tribe except those authorized by the mining plan previously approved by the U. S. Geological Survey. The injunction is to remain in effect until the Secretary of Interior has considered approval pursuant to an adequate federal environmental impact statement.

This Preliminary Environmental Review(P.E.R.) assesses the proposed amendment to Westmoreland's 1975 mining plan and the alternate mining plan to this amendment that was subsequently submitted. The power line which was earlier approved is not considered in the review.

2. History

On February 1 1974, Westmoreland Resources was issued a strip mining permit by the Department of State Lands for the first year of mining (Permit #74005). In total, the acreage affected during the first year was 340 acres. These included: the uncovering of 39 acres of coal, the disturbance of 87 acres for the placement of boxcut spoils, the placement of topsoil on 11 acres, 59 acres disturbed by the construction of haul, access, and other roads, 95 acres disturbed by the construction of rail loop and enclosed structures, the disturbance of 10 acres for a settling pond and the construction of other facilities affecting 35 acres. On February 1, 1975 a renewal of permit #74005 was issued by the Department in order to maintain haul roads, to continue reclamation activities, and to mine an additional 31 acres of coal. Westmorelands' first year of mining was covered in a Final Environmental Impact Statement (E.I.S.) issued by the Department on December 14, 1973.

On March 11, 1975, the Department issued a second mining permit (#75005) to Westmoreland. The second year permit covered the conversion of 55 acres of land from associated mining disturbance to active mining. Impacts of the second year of mining were assessed by the Department in an Addendum to the Final Westmoreland E.I.S. that was issued on January 17, 1975. This supplement covered the proposed area to be mined in 1975 and included only additional information and changes submitted by Westmoreland Resources since the issuance of the Department's final statement.

In addition to the two impact statements written by the Department of State Lands, the Department of Interior submitted a Final Environmental Impact Statement on the Crow Ceded Area Coal Lease - Westmoreland Mining Proposal on January 29, 1974. This impact statement analyzed the impacts of Westmoreland's first year mining proposal and provided data on all of the Ceded Area's Tract III. The reader is referred to the three previous impact statements mentioned above for background data on the Sarpy Creek Mine and on the Tract III area.

3. Location

Westmoreland's Sarpy Creek Mine, including the new areas proposed for disturbance, are located in Big Horn County, Montana. The legal description of the mine site and associated disturbances are Sections 23,24,25 and 26, T.1N, R.37E and Section 30, T. 1N, R.38E. An access road to the mine and mine facilities is located in Section 23, T. 1N, R.37E.

4. Mining Plan

The acreage that Westmoreland is requesting be added to their second year mining permit are shown on Exhibit I. The alternate mining plan submitted on July 31, 1975, is shown on Exhibit II.

Exhibit II, shows the location and sequence of cuts to be made to the Rosebud-McKay seam and to the Robinson seam. The general plan is to confine mining activities to Sections 25 and 26 until such time as extended mining plans are approved pursuant to the appropriate Federal Environmental Impact Statement. Just as soon as the approval has been received, the mining will proceed either to the Northwest or to the southeast, depending on the situation at the time and appropriate approvals. A more complete description of the amended mining plan and the considerations given to the Coal Conservation Act are given in Appendix I.

Present planning by Westmoreland indicates that the mine will be in operation for a period of 20 years, delivering approximately 77 million tons of coal to 4 customers in the Upper Midwest. The quality of coal to be mined in 1975-76 is described in the Addendum Impact Statement written by the Department on January 17, 1975.

5. Alternatives to the Proposed Action

Denial of the permit would mean that Westmoreland would continue to mine under their two existing permits. The recoverable coal able to be mined under these permits is limited however and assuming no further permits or permit amendments were approved, Westmoreland would be forced to shut down their Sarpy Creek operations by an estimated date of January 1976.

The Final E.I.S. issued by the Department stated the following regarding denial of the original Westmoreland permit:

. . . . . The Crow Tribe would lose the royalty payments from this particular coal, the jobs generated by the mine, and the accompanying rise in their standard of living. However, the Crow Tribe has the option of possible coal exchanges and the development of the large reserves on the reservation itself, where the surface, the minerals, and the coal are all owned by the Crow Tribe.

Denial of the permit would force the energy companies having coal sales contracts with Westmoreland Resources to find new sources of low sulphur coal to fuel their midwestern generating plants and would eliminate this specific area as a potential mine mouth gasification plant site. . . . .

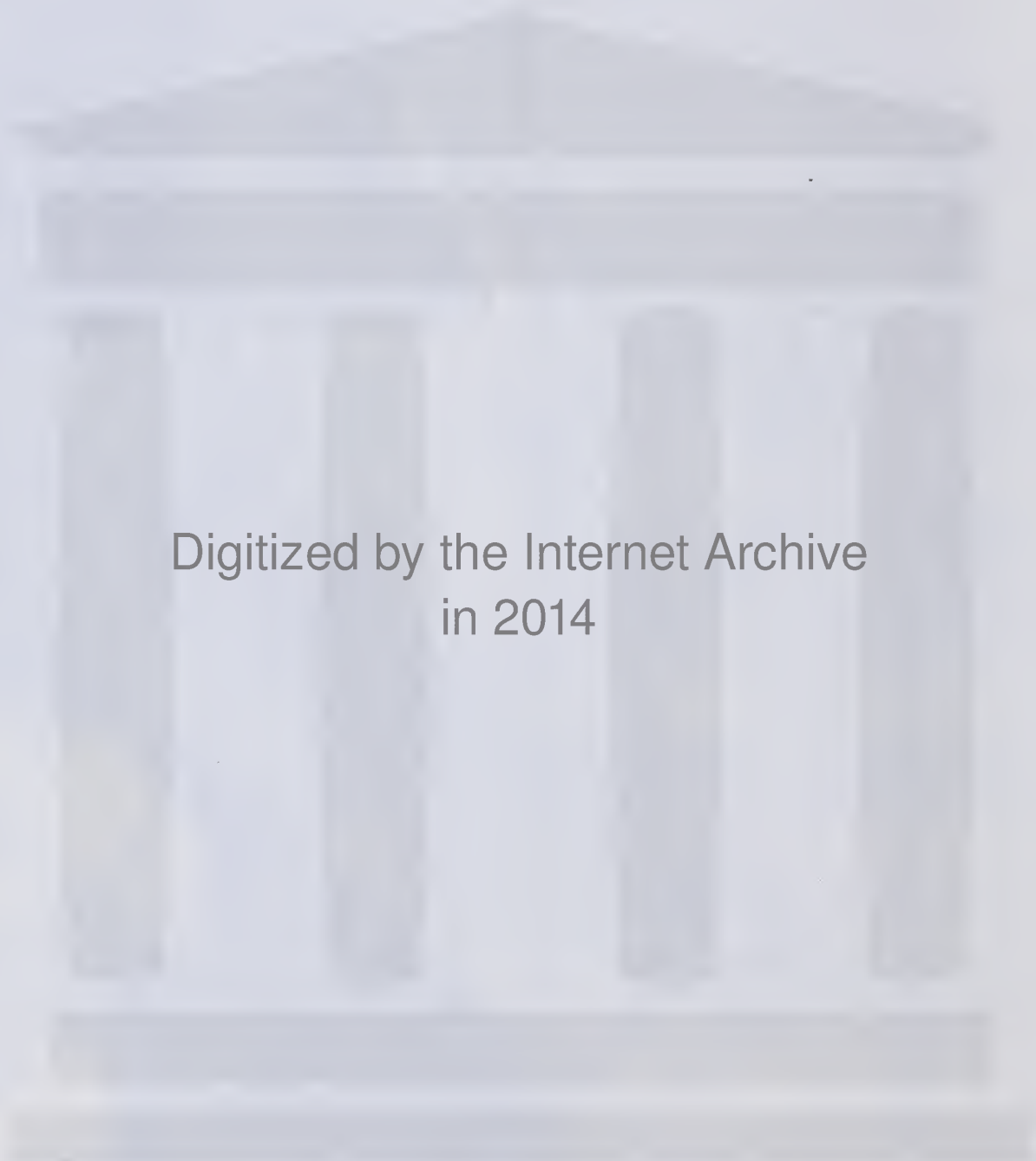
Coal mining methods other than stripping, alteration of the mining and/or reclamation plan and the utilization of other forms of energy have been adequately discussed in previous impact statements written on the Westmoreland Mine (M.D.S.L. 1973, U.S.D.I. 1974).

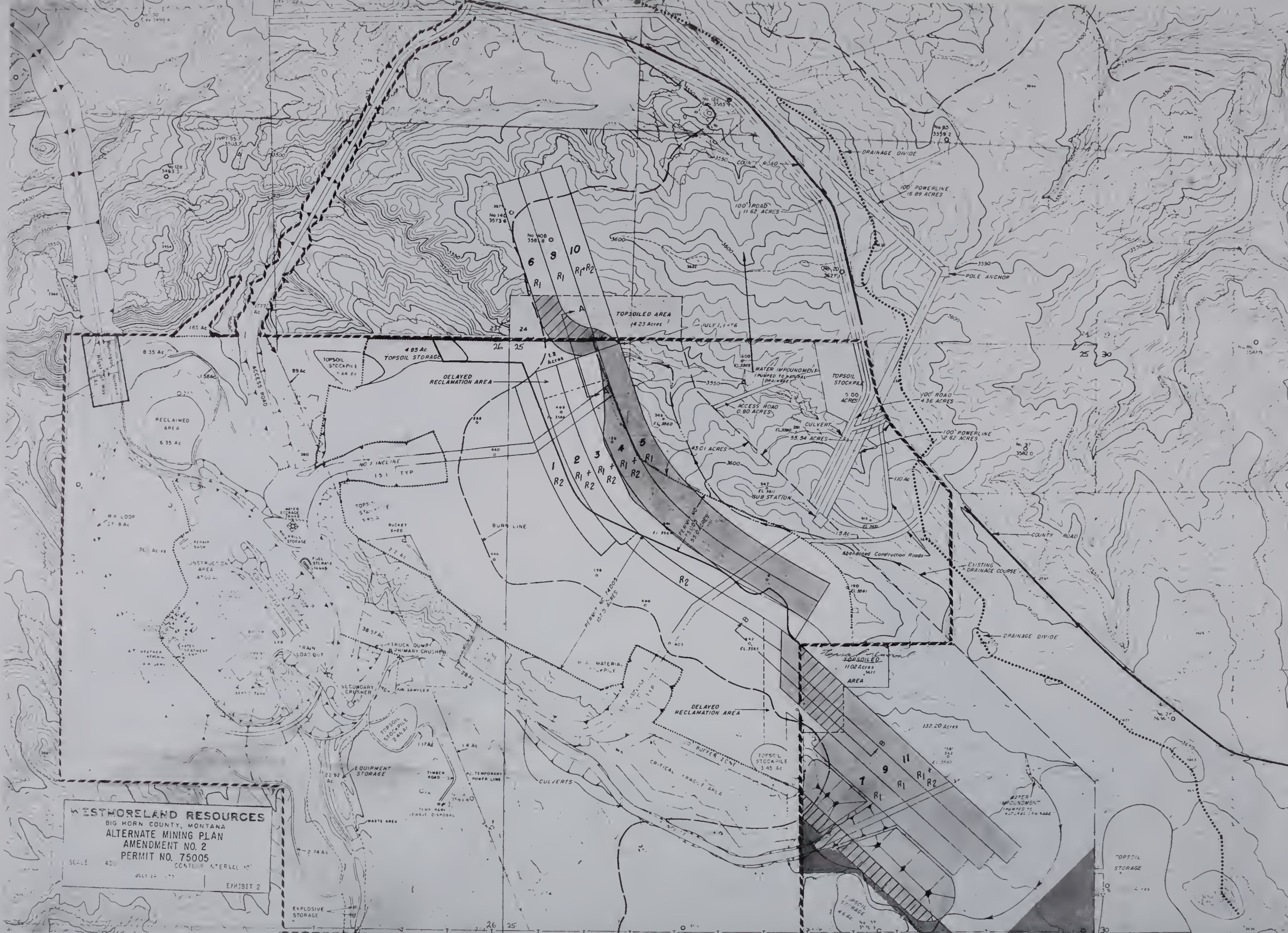
6. Impacts on the Physical Environment

a. <u>Terrestrial and aquatic life and habitats</u>

Wildlife data on Westmoreland Resources Tract III are found in reports by the Ecological Consuling Service (1974, 1975a, 1975c) and in the Department of Interiors' Final Impact Statement (U.S.D.I. 1974).

WESTMORELAND RESOURCES
BIG HORN COUNTY, MONTANA
MINE MAP
AMENDMENT TO PERMIT NO. 75005
SCALE 1" = 400' CONTOUR INTERVAL 10'
APRIL, 1985
EXHIBIT 1




WESTMORELAND RESOURCES
BIG HORN COUNTY, MONTANA
ALTERNATE MINING PLAN
AMENDMENT NO. 2
PERMIT NO. 75005
EXHIBIT 2
TOPSOILED AREA
14 23 Acres
JULY 1, 1976
DRAINAGE DIVIDE
COUNTY ROAD
100' POWERLINE
16 89 ACRES
100' ROAD
11 62 ACRES
POLE ANCHOR
WATER IMPOUNDMENT
(PUMPED TO NATURAL DRAINAGE)
TOPSOIL STOCKPILE
5 00 ACRES
100' ROAD
4 36 ACRES
ACCESS ROAD
0.80 ACRES
CULVERT
55.54 ACRES
100' POWERLINE
2 62 ACRES
43 01 ACRES
SUB STATION
Abandoned Construction Roads
EXISTING DRAINAGE COURSE
DRAINAGE DIVIDE
4 85 Ac.
TOPSOIL STORAGE
TOPSOIL STOCKPILE
DELAYED RECLAMATION AREA
1.2 Acres
ACCESS ROAD
RECLAIMED AREA
6 35 Ac
8 35 Ac
NO 1 INCLINE
BURN LINE
R R LOOP
27 8 Ac
CONSTRUCTION AREA
PERMIT NO 74005
PERMIT NO 75005
TRAIN LOAD OUT
TRUCK DUMP
PRIMARY CRUSHER
SECONDARY CRUSHER
TOPSOIL STOCKPILE
2 45 Ac
EQUIPMENT STORAGE
22 92 Ac
EXPLOSIVE STORAGE
CULVERTS
BUFFER ZONE
CRITICAL FRAGILE AREA
DELAYED RECLAMATION AREA
TOPSOIL STOCKPILE
3 45 Ac
TOPSOILED
1102 Acres
AREA
132.20 Acres
WATER IMPOUNDMENT
TOPSOIL STORAGE
TOPSOIL STORAGE
1 2 3 4 5 6 9 10 7 9 11
R1 R2

The interspersion of vegetation cover types in the Tract III area provides good to excellent habitat conditions for a wide variety of wildlife species. The most common game animals observed included are mule deer, sharptailed grouse, and ringnecked pheasant. Others that are less common or seasonal include pronghorn antelope, white-tailed deer, waterfowl, Merriam's Turkey and Hungarian Partridge. Nongame animals included coyotes, and several different raptors. With the possible exception of seven (7) grouse dancing grounds, no critical wildlife habitat has yet been identified on the Tract III area.

Strip mining and other disturbances in the amended permit area will result in at least temporary loss of food and cover for many species. The quality of the habitat will be further reduced by increased human intrusions into areas adjacent to the mine site, increased noise, and by new roads and fences. The duration of such a decline in quality depends upon the success of reclamation and upon the individual species ability to tolerate the increased presence of man.

The loss of wildlife habitat in the amended area when added to the area disturbed by the two previous Westmoreland permits is cumulative; to date however, the total acreage disturbed is so small as to be of little significance in the area.

One sharptail dancing ground is located within the amended permit area (SW¼ of Sec. 24). This particular location is designated as "associated disturbance." A maximum of 14 birds have been observed on the dancing ground by Departmental staff. A factor potentially affecting the dancing grounds' integrity is the construction of a 100 foot wide access road which will parallel the existing county road in Sections 23 and 24. Other potential factors are expansion of the mine closer to the dancing ground and the associated increase in noise and mechanical disturbances in the area. This particular site will be removed by mining according to Westmoreland's 20 year mining plan.

In 1975 Westmoreland Resources contracted the Ecological Consulting Service to conduct research on the feasibility of recreating or relocating sharptail dancing grounds.

The amended area is within the Sarpy Creek drainage. To date, no significant impacts of mining on down stream fisheries have been observed.

b. Water quality, quantity and distribution

It is doubtful that the mine extension will significantly impact the already stressed hydrologic system. It is also unlikely that the mine will significantly impact Sarpy Creek through discharge of undesirable waters from the settling pond.

Aquifers that might be affected by the mining operation are coal, siltstone, and sand stone beds, all of which are relied upon for stock and domestic water supplies. Mining will disturb three aquifers or aquifer zones: one in the Rosebud-McKay coal, and one near the Robinson coal. The original permeability of the mined out coal beds will be greatly diminished (M.D.S.L. 1975).

One stock watering pond and four ephemeral streams are located on the amended permit area. The drainage pattern of the streams will be destroyed by mining; however, the recontouring that occurs during reclamation will connect the reclaimed areas with undisturbed drainage patterns down stream. No acid drainage problems have yet occurred on Westmoreland Resources' mined area and none are anticipated in the amended area.

All waters affected by mining activity will flow into the existing settling pond and then be discharged to Sarpy Creek. This discharge is permitted by the Montana Department of Health and Environmental Sciences. To date no water quality violations have occurred.

Dames and Moore, consultants to Westmoreland Resources, are presently establishing a more complete monitoring system for both surface and ground water than that previously reported.

c. Soils and overburden

A soild survey was submitted as part of the amendment application. This survey included a full report, map, and appropriate chemical analyses (Westmoreland Resources 1975a). Twelve soil types were identified on the amended area; suitability for retopsoiling varied.

Two hundred and fifty-five (255) additional acres will be disturbed by mining in the amended permit area. The original soil profiles will be disrupted and when the area is retopsoiled, mixing of the original soils will have occurred. Stripping of the overburden and coal should increase the porosity of the material (U.S.D.I. 1974). Changes will also occur affecting slope gradient, depth to water, chemical composition, soil microorganisms and other characteristics (U.S.D.I. 1974).

The effect that retopsoiled areas will have on revegetation depends partially on the placement of the overburden and interburden. For that reason, the high sodium layer found just above the Robinson coal seam and also those layers having extremely low permeability will be buried under desirable fill material.

Data on four (4) new core holes have been submitted to the Department since the issuance of the second year mining permit (C.S.M.R.I. 1975a, 1975b). Two of these holes are located within the amended area and two are immediately adjacent to it. The location of the four new core holes are located on Exhibit I (#140B, #562, #546, & #547). Complete analyses of these holes are included in Appendix II. The Department's current determinations based on these analyses are as follows:

> The macronutrients nitrogen and phosphorus are low. The Colorado School of Mines Research Institute (1975b) recommended 250 lb of P_2O_5 and 50 lb of nitrogen be applied to the graded spoil prior to topsoiling. This may be a better way to apply fertilizer than on the topsoil and the Department would like to observe the differences, if any, in plant response.

The imbalance of micronutrients in strata of some holes may limit their availability to plants. For example in hole #546, 10 to 20 feet, iron is high while copper and zinc are low. The iron could limit plant uptake of copper and zinc. High concentrations of zinc and low concentrations of iron are found in hole #546, 60 to 68 feet; and in hole #547, 36 to 41 feet, 154 to 168 feet, and 178 to 184 feet. The high zinc could prevent plants from obtaining sufficient iron. The mixing that occurs during mining should, however, eliminate micronutrient imbalances. If nutrient deficiencies do occur they can easily be remedied by fertilization.

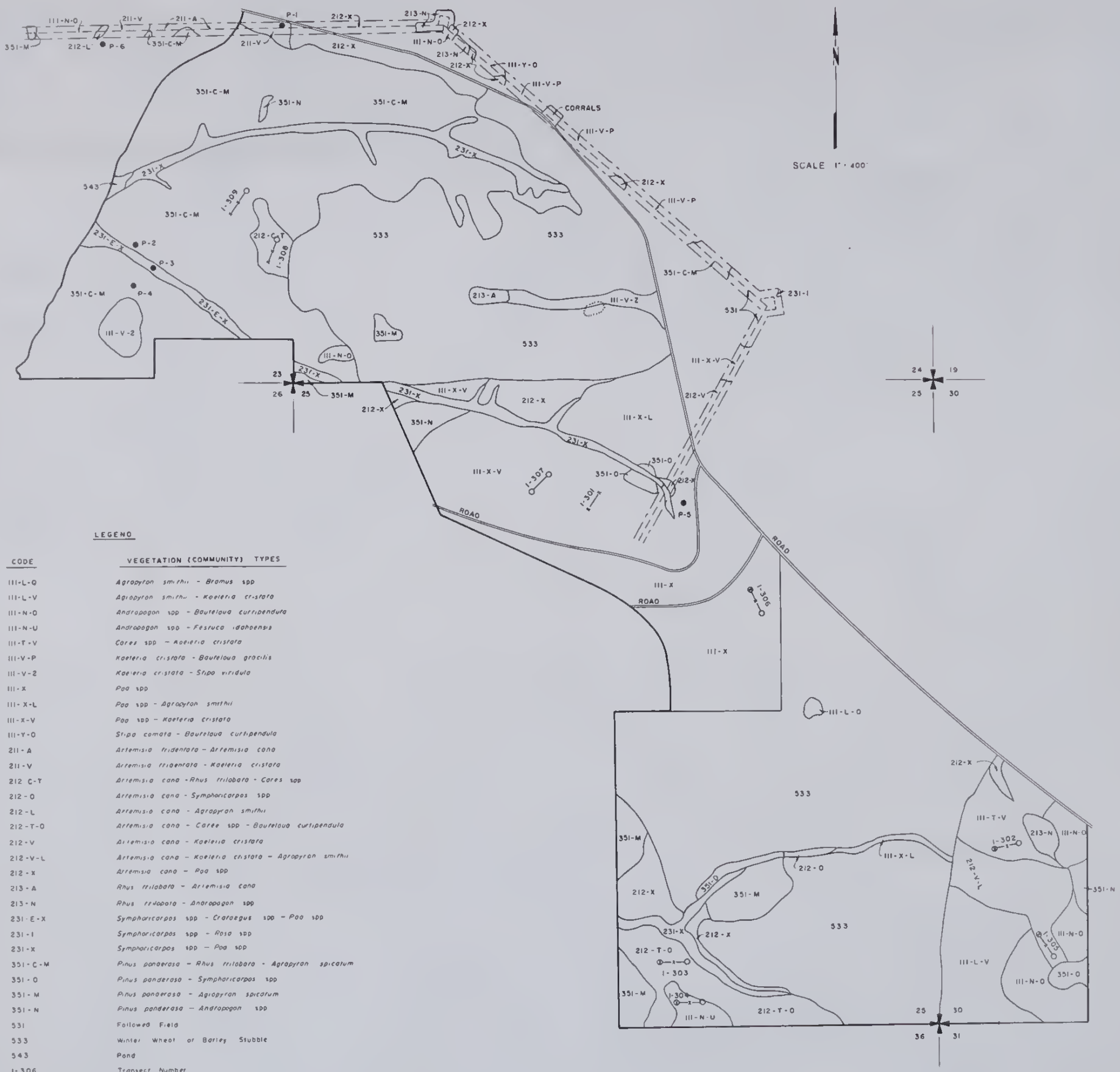
The trace mineral, lead, is high in some parts of all four holes, however, with the mixing during stripping, in addition to the spoil being covered with a topsoil layer, no toxicity should occur.

d. Vegetation cover, quantity, and quality

Eight major native communities were found on the amended permit area: four grassland community types, three shrub-grassland communities, and one timber-grassland community (E.C.S. 1975c). The location of these and other smaller communities are shown on the following page. Appendix III gives summaries of the annual biomass production, range condition, and recommended stocking rates for the 8 major communities identified.

Strip mining will completely destroy all the vegetation on the area from which the topsoil is removed. Existing vegetation will also be destroyed on those areas designated for topsoil storage, roads, water impoundments, substations, and other structures. Mined lands will be reclaimed subject to the provisions of the Montana Strip and Underground Mine Reclamation Act. Long range productivity of the area is dependent upon successful reclamation. According to the Reclamation Act, the permanent, diverse vegetation cover that is required must be capable of regenerating under natural conditions and be able to withstand grazing pressure comparable to that prior to strip mining.

VEGETATION MAP FOR WESTMORELAND RESOURCES AMENDED
1975 MINING PERMIT AREA
SEPT 15, 1975



LEGEND

CODE	VEGETATION (COMMUNITY) TYPES
111-L-Q	*Agropyron smithii - Bromus spp*
111-L-V	*Agropyron smithii - Koeleria cristata*
111-N-O	*Andropogon spp - Bouteloua curtipendula*
111-N-U	*Andropogon spp - Festuca idahoensis*
111-T-V	*Carex spp - Koeleria cristata*
111-V-P	*Koeleria cristata - Bouteloua gracilis*
111-V-2	*Koeleria cristata - Stipa viridula*
111-X	*Poa spp*
111-X-L	*Poa spp - Agropyron smithii*
111-X-V	*Poa spp - Koeleria cristata*
111-Y-O	*Stipa comata - Bouteloua curtipendula*
211-A	*Artemisia tridentata - Artemisia cana*
211-V	*Artemisia tridentata - Koeleria cristata*
212 C-T	*Artemisia cana - Rhus trilobata - Carex spp*
212-O	*Artemisia cana - Symphoricarpos spp*
212-L	*Artemisia cana - Agropyron smithii*
212-T-O	*Artemisia cana - Carex spp - Bouteloua curtipendula*
212-V	*Artemisia cana - Koeleria cristata*
212-V-L	*Artemisia cana - Koeleria cristata - Agropyron smithii*
212-X	*Artemisia cana - Poa spp*
213-A	*Rhus trilobata - Artemisia cana*
213-N	*Rhus trilobata - Andropogon spp*
231-E-X	*Symphoricarpos spp - Crataegus spp - Poa spp*
231-I	*Symphoricarpos spp - Rosa spp*
231-X	*Symphoricarpos spp - Poa spp*
351-C-M	*Pinus ponderosa - Rhus trilobata - Agropyron spicatum*
351-O	*Pinus ponderosa - Symphoricarpos spp*
351-M	*Pinus ponderosa - Agropyron spicatum*
351-N	*Pinus ponderosa - Andropogon spp*
531	Followed Field
533	Winter Wheat or Barley Stubble
543	Pond
1-306	Transect Number
⊢—⊣	Vegetation Transect (100')
○—○	Clipping Transect (200')
● P-1	Small Mammal Trap-line
	Sharp-tailed Grouse Dancing Ground
	Proposed Power Line Corridor
	Permit Area

e. Aesthetics

The addition of substantial new acreage to the already permitted area will have a cumulative aesthetic effect as the size of the strip mine within the Sarpy Creek Basin will be enlarged. Regrading, recontouring, and revegetation may eventually return the overall visual effect (M.D.S.L. 1973).

f. Air quality

Exhaust emissions from operational vehicles and mining equipment will have a minimal affect on air quality. A more serious source of air pollution will be fugitive dust, however, the offensiveness of such dust will be minimized if haul roads are kept adequately watered (U.S.D.I. 1974).

g. Unique, endangered, fragile or limited environmental resources

The Department has determined that the amended area does not possess special, exceptional, critical or unique characteristics as defined in Section 9(2) of the Montana Strip and Underground Mine Reclamation Act.

h. Historical and archaeological sites

There is no evidence that significant historic and archaeological qualities exist in the area. The area served as a buffer zone among warring Indian factions, but no major events apparently occurred. The surface lands were subsequently ceded to the federal government and eventually homesteaded by the white man (Westmoreland Resources 1975a).

i. Demands on environmental resources of land, water, air and energy

As new permits facilitate the expansion of the Westmoreland mine, highly productive lands that are important to viable ranching operations in the Westmoreland-Sarpy Creek area will be temporarily lost (M.D.S.L. 1973). This amendment eliminates 570 acres of range and agricultural land for the interim period between permit approval and reclamation. If successful reclamation is not accomplished, the surface utility of the mined land will have been relinquished for mineral production.

Additional energy demands necessitated by the expansion of the Westmoreland Mine include a 69 KV electrical transmission line. This line was installed for the operation of electric drills and for a new dragline. Current usage on the transmission line amounts to 200,000 watts per month. (pers.com. with R. Moore , Vice President-Operations, Westmoreland Resources Nov. 5, 1975).

No significant demands are anticipated on water and air resources as a result of the amended permit proposal.

7. Impacts on the Human Environment

a. Tax revenues

Westmoreland Resources' Sarpy Creek Mine provides considerable tax revenues to both the State and to Big Horn County. Approval of the amended permit facilitates the ample revenue flow from the Westmoreland operation to continue unabated. Below is a table of the estimated taxes resulting from the Sarpy Creek mine operation. Estimates were obtained from Joe Presley, Controller for Westmoreland Resources in Billings (pers.com.Nov. 5, 1975). They are based on the assumption that the 1975 amended permit and future permit applications are approved. Not included in the table are royalties paid to the Crow Tribe, Burlington Northern rail taxes, corporation license taxes, or employment security taxes.

Year	Estimated Coal produced[1] (milliontons)	Severance[2] (dollars)	Gross Proceeds[3] (dollars)	Resource Indemnity[4] (dollars)	Property[5] (dollars)
1975	4	3,000,000	1,000,000	50,000	100,000
1976	4	5,000,000	1,350,000	50,000	100,000
1977	4	5,900,000	1,600,000	60,000	100,000
1978 and thereafter	4.5	5,900,000	1,600,000	60,000	400,000

1. Westmoreland has tentative plans to mine 10 million tons annually starting in 1979 assuming that a second dragline will be operational at that time. This would of course change the estimated tax revenue.
2. The new coal severance tax provides revenues for the state general fund, the impacted county's general fund and to 8 other funds.
3. Basically a property tax to the county.
4. To the State.
5. Mostly to the county. As a rule of thumb 98% of all property taxes go to local governments. The estimated sums given here include taxation on both Westmoreland and Morrison-Knudsen property.

b. Employment, income, and housing

It is not expected that the expansion of the existing Westmoreland mine will significantly add to the current work force. The current payroll of persons employed at the mine is approximately 1.5 million dollars annually (per. com. with R. Moore, Nov. 5, 1975).

Westmoreland Resources currently employs 6 persons at the mine site. Morrison-Knudsen, a partner in Westmoreland Resources and the contractor who works on the project employs 105 persons. Of the personnel working for Morrison-Knudsen, 22 are administrative and supervisory and 83 are hourly employees. Approximately 60 percent of the Morrison-Knudsen employees are members of the Crow Tribe (pers. com. with R. Moore Nov. 5, 1975).

Most of the mine site employees live either in the town of Hardin or on the Crow Indian Reservation. Because the mine expansion will not significantly add to the work force, housing problems resulting from the expansion are not expected.

c. Agricultural production

Approval of the amended permit would mean a slight short term decrease in the agricultural land base for Big Horn County. If reclamation is successful on this and other strip mined areas, the cumulative impacts on agricultural production should be insignificant.

Approximately 1/3 of the amended permit area is currently devoted to grain production. Portions of the amended permit area in Section 25 (T.1N, R.37E) and Section 30 (T.1N, R.38E) have been planted to winter wheat in recent years. After previously being used for raising hay and for grazing, a portion of the amended area in Section 24 was planted to Barley in 1975. Much of the remaining acreage within the amended area has been used for grazing.

Production data for wheat and barley crops planted in the field in the SW¼ of Section 25 are given in the Final Environmental Impact Statement for the West-

moreland Mine written by the Department. Such data indicated that agriculture is a productive activity in the Sarpy Creek area but not necessarily uniquely productive in terms of the region. The Final Environmental Impact Statement concluded that agricultural fields in the Sarpy Creek vicinity are important to local ranch units since varying topography and soils limit the areas which can be farmed (M.D.S.L. 1973).

d. Human health

Any changes in air and water quality resulting from the proposed expansion should have no significant effect on human health.

Westmoreland will provide mine-site health and accident facilities for its employees including a first aid room, an ambulance in a heated building and communication with medical facilities, All Westmoreland supervisors have Bureau of Mines first aid training (D.S.L. 1973).

e. Transportation and traffic flows

Since the expansion of the existing Westmoreland mine will not significantly add to the number of employees, increased traffic flow on Montana Secondary Highway No. 38 from Hardin to Sarpy Creek are not expected. Portions of the highway between Hardin and Sarpy Creek are planned for resurfacing and other improvements. No changes in creek crossings or changes in right of ways are anticipated, however,

f. Cultural uniqueness and diversity

The fact that archaeologically and historically significant sites are absent indicates that the amended area has no exceptional cultural characteristics to either Indians or Whites. The area does however, have a local cultural significance to ranchers in the area whose families have been caring for and living on the land for several generations (M.D.S.L. 1973).

8. Distribution of the P.E.R.

This statement has been sent to:

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9. Compilation and Writing of the P.E.R.

This statement was compiled and written by Brace Hayden, Environmental Coordinator for the Department of State Lands. Contributing to the P.E.R. and providing critical review were members of the Department's Reclamation Division and the Commissioner.

9 REFERENCES

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Appendix I

Amended Mining Plan

The amended mining plan described below is presented in the form submitted to the Department on July 31, 1975.

Westmoreland Resources's general plan is to confine mining activities to Section 25 and 26 until such time as extended mining plans are approved pursuant to appropriate Environmental Impact Statements. Just as soon as the approval has been received, the mining will proceed either to the NW or to the SE, depending on the situation at the time and approval by the Department of the Interior. We estimate that the Department of the Interior will be in a position to grant approval by 1 July 1976. On this date the mining will be as depicted on Exhibit 2. Mining will then proceed with a box cut oriented east - west placing the overburden material to the south on spoils previously mined. When this box cut reaches the "burn line" to the west, the cut will be turned to the northwest and follow the "burn line" to the NW until it reaches the point where the "burn line" turns to the east and limits the northwesterly extension of the cut. Exhibit 2 displays this as sequence #6.

The next step in the operation will be to move the dragline to the SE extension. It will "chop in" as close as possible to the eastern end of cuts previously taken and mine to the SE, placing spoil material to its left as close as possible to the "critical-fragile area" in order to recover as much coal as possible.

The normal sequence then will be to alternate cuts to the northwest and to the southeast until continuity has been established with cut #5 as shown on Exhibit 2. When this has been accomplished, work will be concentrated in the SE area in order to catch up with the previous cuts to create a workable mining operation with a basic cut length of 7500 feet or more.

On the other hand, due to variable requirements of customer demand, ability to receive coal and varying problems of the delivering railroad, such as operational problems of severe cold, severe heat, severe floods, derailments and other Acts of God, Westmoreland Resources's ability to mine in this specific pattern may be altered. As Exhibit 2 shows, there is only one haul road shown for the removal of coal from the SE extension. Assuming even shipments of coal, it should be possible to concentrate effort in the SE extension until such time as these cuts can be in line with the cuts in Permit 75005. If operational problems beyond the control of Westmoreland Resources should arise, it may well be necessary to mine an additional cut to the NE of cut #5 in order to avoid interruptions to shipments required pursuant to existing contracts.

Topsoil storage areas to the extreme SE have been altered to conform to the cuts proposed in the alternate mine plan.

Westmoreland Resources will construct the new access road as soon as possible and take topsoil to the NW and SE of cuts 1, 2, 3, 4, and 5 in order to avoid the possibility of contamination from mining activities within the area approved by Permit 75005.

As it is presently planned, assuming approval of extended mining plans by the Department of the Interior on 1 July 1976, cut #4 will be available for recontouring in the latter part of 1976.

Next, the box cut and an area 400 feet in width parallel to the south line of Section 24 will be available for recontouring in the spring of 1977. The recontouring of the former "buffer zone" area to the southeast will be delayed until early 1977 although recontouring of the cuts themselves may be accelerated. The unrecontoured area to the NW has not been mined previously. The area to be delayed in reclamation to the SE has been mined in the first year of Westmoreland Resources's activity.

Westmoreland Resources will, of course, continue to pursue its policy of reclamation as soon as possible. At present, box cut spoils to the NW have been recontoured and seeded in 1975. Mining to the Robinson seam of coal is proceeding on schedule and will create areas available for recontouring and seeding in the near future. As you know, Westmoreland Resources's requirement under Permit 74005 delayed reclamation until a second cut to the Robinson seam had been achieved, particularly in the area to the SE where reclamation activities are restricted by the creation of a "critical-fragile" area.

Westmoreland Resources has prepared this plan in accordance with the Coal Conservation Act. There will probably be some loss of coal at the western extremity of the box cut to develop cut 6, depending on the time schedule of federal approval. Westmoreland Resources estimates these losses to be 66,250 tons of Rosebud-McKay coal. There will also probably be coal lost in the previously existing buffer zone due to restricted areas for placement of overburden material. Westmoreland Resources estimates these losses to be 100,000 tons of Rosebud-McKay.

The Robinson seam will be developed as previously specified i.e. after 3 cuts have been developed to the Rosebud-McKay seam and losses will be approximately as set forth in the Application for An Approval of Amended Mining Plan submitted to the Department of State Lands 30 May 1975, pursuant to the Coal Conservation Act.

Appendix II

Analyses of Overburden and Interburden

TABLE 1A

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 140B

Sample No.	Interval, ft From	To	pH Paste	Saturation Percentage(1)	Saturation Extract: Soluble Salt Electrical Conductivity millimhos/cm	Sodium millequivalents/liter	Calcium millequivalents/liter	Magnesium millequivalents/liter	Sodium Adsorption Ratio(2)
264	0	5	7.70	34.4	7.0	0.45	0.58	1.40	<1
265	5	10	7.82	30.5	7.7	0.40	0.81	1.62	<1
266	10	16	5.72	33.1	6.6	0.31	1.09	1.20	<1
267	16	20	3.78	70.2	8.5	0.91	2.06	5.05	<1
268	20	24	6.19	44.9	7.0	0.31	1.33	2.07	<1
269	24	31	7.29	35.1	4.9	0.17	0.54	1.03	<1
270	31	37	7.04	47.5	5.5	0.21	0.78	1.58	<1
271	37	45	7.03	40.8	4.2	0.16	0.63	0.93	<1
272	45	54	7.09	37.5	3.5	0.22	0.46	0.65	<1
273	54	62	6.76	39.6	4.8	0.44	0.71	0.66	<1
274	62	72	7.30	36.4	2.8	0.56	0.21	0.21	1.2
275	72	82	7.06	37.7	4.7	1.46	0.18	0.15	3.6
276	82	89	8.09	86.3	2.8	2.33	1.14	0.03	3.0
277	89	94	7.22	29.5	4.1	1.08	0.12	0.05	3.7
278	125	131	7.44	46.8	3.9	1.81	0.07	0.04	7.7
279	135	140	7.84	47.8	2.4	1.20	0.03	0.01	8.5
280	140	150	7.81	45.5	4.4	1.78	0.08	0.05	7.0
281	150	160	7.43	30.9	4.7	1.32	0.11	0.05	4.7
282	160	164	7.63	34.7	3.7	1.18	0.06	0.03	5.6
283	164	171	7.70	41.6	4.1	1.56	0.06	0.03	7.4
284	171	177	7.57	46.3	3.0	1.29	0.06	0.03	6.1
285	177	183	7.93	60.5	3.7	2.10	0.08	0.03	9.0
286	205	210	7.59	49.8	3.1	1.30	0.14	0.07	4.0
Comp	0	94	6.20	40.4	6.4	1.00	1.10	0.93	1.0
Comp	125	183	7.90	43.9	3.5	1.43	0.06	0.03	6.7

1/ Calculated from the equation: $\text{Saturation Percentage} = \frac{100 \times (\text{Total weight of water})}{\text{Total Weight of Air-Dried Soil}}$.

2/ Calculated from the equation: $\text{Sodium Adsorption Ratio} = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$.

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 140B

Sample No.	Interval, ft From	To	Nitrate ppm	Ammonium ppm	Boron Water Soluble ppm	Molybdenum Acid Ammonium Oxalate Soluble ppm	Selenium Available ppm	DTPA Extractable Cu ppm	Fe ppm	Mn ppm	Zn ppm	Ni ppm	Cd ppm	Pb ppm	Mercury Total ppb
264	0	5	17.5	24.2	<0.10	1.08	0.02	1.7	175	98.4	29.4	4.3	0.04	4.0	35
265	5	10	8.0	43.4	2.20	0.66	0.01	0.6	107	42.0	5.6	1.6	0.12	3.6	30
266	10	16	30.5	51.0	4.40	3.76	0.02	0.8	1028	30.3	6.7	2.2	0.12	1.2	130
267	16	20	60.5	12.1	5.40	1.84	0.01	0.2	852	13.9	2.2	0.8	0.08	0.4	50
268	20	24	21.5	44.1	1.00	0.69	0.02	4.8	479	60.8	110.0	3.4	0.24	6.8	80
269	24	31	4.5	40.8	1.40	0.94	0.01	1.5	296	89.6	14.6	2.2	0.08	6.4	30
270	31	37	<1	39.0	<0.10	0.96	0.02	6.4	350	39.6	11.0	4.0	0.08	15.8	55
271	37	45	8.0	31.1	<0.10	0.66	<0.01	4.0	317	79.6	44.0	3.1	0.16	12.4	100
272	45	54	6.0	34.6	1.40	0.73	<0.01	4.2	364	46.4	17.7	3.6	0.08	28.4	70
273	54	62	<1	32.9	0.40	1.15	<0.01	1.8	514	27.2	8.8	3.9	0.04	29.2	100
274	62	72	<1	34.6	1.10	1.36	0.01	6.0	440	26.3	20.3	4.6	0.08	27.6	60
275	72	82	<1	39.7	<0.10	1.15	0.03	1.5	544	19.6	8.3	5.0	0.04	7.2	60
276	82	89	<1	40.0	2.80	0.59	0.10	13.0	342	8.3	60.9	6.0	0.12	9.6	140
277	89	94	<1	33.7	0.64	0.87	0.04	1.8	348	18.4	12.1	6.5	0.08	5.6	75
278	125	131	<1	31.1	2.60	0.94	0.04	6.9	164	10.0	152.0	11.0	0.20	11.6	160
279	135	140	2.5	35.5	0.40	0.94	0.08	3.8	378	34.6	10.2	3.4	0.04	14.8	130
280	140	150	<1	32.9	0.90	0.59	0.01	3.9	276	18.8	135.0	3.2	0.08	8.8	100
281	150	160	<1	29.4	1.00	0.87	0.01	1.7	440	13.2	24.1	3.1	0.04	9.2	70
282	160	164	1.5	39.7	<0.10	0.83	<0.01	1.7	387	17.4	197.0	2.8	0.12	10.0	65
283	164	171	<1	30.3	0.32	1.01	0.04	2.0	464	23.6	25.5	5.2	0.04	8.8	65
284	171	177	<1	45.0	1.20	1.56	<0.01	3.5	496	32.6	15.2	6.3	0.08	9.2	90
285	177	183	<1	26.0	1.20	1.00	0.04	11.7	468	22.5	14.3	6.3	0.04	14.8	90
286	205	210	<1	24.2	<0.10	1.40	0.04	8.8	237	6.3	21.6	10.3	0.08	10.8	140

23.2

44.7
23.7
2/67 (33.9

8.87 ave overall

31' coal

4' coal

22' coal

TABLE 2A

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 562

Sample No.	Interval, ft From	To	pH Paste	Saturation Percentage(1)	Saturation Extract: Soluble Salt Electrical Conductivity millimhos/cm	Sodium millequivalents/liter	Calcium millequivalents/liter	Magnesium millequivalents/liter	Sodium Adsorption Ratio(2)
287	0	5	7.92	34.5	0.2	0.01	0.06	0.06	<1
288	5	15	8.25	32.0	0.3	0.01	0.02	0.08	<1
289	15	25	8.16	30.9	0.5	0.06	0.05	0.10	<1
290	25	30	7.90	35.4	1.0	0.06	0.11	0.17	<1
291	30	34	7.41	50.2	2.6	0.10	0.54	0.72	<1
292	39	42	7.23	62.4	1.1	0.19	0.25	0.27	<1
293	42	46	7.50	38.7	1.7	0.13	0.27	0.26	<1
294	46	55	7.10	51.4	1.3	0.29	0.25	0.21	<1
295	88	92	7.60	43.3	2.1	0.94	0.03	0.02	5.9
296	96	104	7.83	40.0	2.3	0.94	0.03	0.01	6.7
297	104	108	8.53	77.0	1.5	1.21	0.03	0.01	8.6
298	108	118	7.94	37.0	2.8	0.94	0.04	0.02	5.4
299	118	124	8.29	28.8	1.7	0.52	0.01	0.01	5.2
300	124	133	8.17	41.5	1.4	0.63	0.01	0.01	6.3
301	133	137	8.20	68.3	1.7	1.25	0.03	0.01	8.8
302	137	147	8.23	36.7	2.0	0.82	0.02	0.01	6.7
303	147	150	8.52	97.8	1.5	1.64	0.04	0.01	10.4
304	170	175	8.02	54.2	1.5	0.95	0.03	0.05	4.8
Comp	0	55	7.56	36.0	1.1	0.09	0.14	0.19	<1
Comp	88	150	8.18	44.1	0.8	0.44	0.02	0.01	3.6

1/ Calculated from the equation: $\text{Saturation Percentage} = \frac{100 \times (\text{Total weight of water})}{\text{Total Weight of Air-Dried Soil}}$.

2/ Calculated from the equation: $\text{Sodium Adsorption Ratio} = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$.

TABLE 2B

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 562

Sample No.	Interval, ft From	To	Nitrate ppm	Ammonium ppm	Boron Water Soluble ppm	Molybdenum Acid Ammonium Oxalate Soluble ppm	Selenium Available ppm	DTPA Extractable Cu ppm	Fe ppm	Mn ppm	Zn ppm	Ni ppm	Cd ppm	Pb ppm	Mercury Total ppb
287	0	5	7.0	20.8	1.00	0.41	<0.01	2.8	172	118.0	9.9	2.2	0.04	2.4	25
288	5	15	<1	19.9	4.80	0.95	<0.01	1.4	173	97.2	5.9	1.9	0.04	4.8	10
289	15	25	<1	20.3	1.20	1.30	<0.01	1.1	130	48.8	9.4	2.1	0.04	4.4	10
290	25	30	6.0	19.1	0.90	0.63	<0.01	0.9	200	60.0	5.9	2.3	0.04	3.2	15
291	30	34	<1	34.7	3.00	0.42	0.02	2.7	475	25.8	9.3	3.1	0.08	4.3	100
292	39	42	1.0	29.5	<0.10	1.37	0.05	3.3	301	16.0	35.1	1.2	0.04	11.2	90
293	42	46	3.5	27.7	3.10	1.66	<0.01	1.4	459	16.6	10.3	4.8	0.04	8.4	50
294	46	55	2.0	32.0	0.70	0.54	0.03	3.7	348	16.5	11.5	5.5	0.08	24.4	120
295	88	92	2.5	29.5	2.80	0.19	0.03	4.8	257	11.2	32.0	4.2	0.08	12.8	95
296	96	104	6.0	33.9	1.90	0.98	0.02	0.9	832	18.3	46.8	3.7	0.04	4.0	75
297	104	108	3.5	43.4	<0.10	0.46	0.03	21.6	266	4.4	8.7	4.2	0.08	11.8	190
298	108	118	3.5	32.0	<0.10	0.67	0.02	4.4	441	23.6	14.1	4.9	0.08	7.6	70
299	118	124	1.0	33.4	1.20	1.15	<0.01	1.5	463	21.2	40.4	2.4	0.04	4.8	30
300	124	133	1.0	33.0	<0.10	1.33	0.01	5.6	488	36.4	11.9	5.4	0.04	6.8	40
301	133	137	<1	43.4	1.40	0.67	0.05	12.8	465	33.4	11.9	8.4	0.08	7.2	75
302	137	147	1.5	26.9	2.20	1.46	0.02	4.6	402	20.8	19.3	3.9	0.12	6.8	65
303	147	150	1.5	43.4	2.30	0.42	0.20	14.4	238	9.7	17.7	9.6	0.16	11.6	320
304	170	175	4.0	38.2	4.80	1.15	0.11	9.1	271	9.8	19.7	7.1	0.04	11.2	110

TABLE 2B

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 546

Sample No.	Interval, ft From	To	Potassium Available ppm	Phosphorus $NaHCO_3$ Soluble ppm	Nitrate ppm	Ammonium ppm	Sulfate Water Soluble ppm (1)	Calcium Water Soluble ppm (1)	Magnesium Water Soluble ppm (1)	DTPA Extractable Cu ppm	Fe ppm	Mn ppm	Zn ppm	Molybdenum Anion Exchangeable ppm	Boron Water Soluble ppm
151	0	10	370	3.0	4.3	18	62	56	48	1.6	150	34.4	1.2	0.33	<1.0
152	10	20	330	11.8	3.0	16	994	264	450	2.0	540	10.0	2.4	0.74	2.2
153	20	30	370	4.6	3.5	12	124	163	60	2.6	168	16.6	5.2	0.27	1.5
154	30	35	575	3.0	1.3	19	79	102	38	2.8	406	32.0	5.2	0.29	<1.0
155	35	44	630	3.6	<1.0	27	178	156	52	5.0	320	25.4	28.0	0.47	1.0
156	44	47	715	4.0	2.8	23	82	68	20	8.2	424	42.4	11.4	0.56	<1.0
157	47	53	485	3.0	<1.0	16	65	58	16	5.0	332	42.4	18.2	0.61	1.4
158	53	60	685	4.0	2.8	12	113	84	20	4.8	388	42.0	12.0	0.82	3.4
159	66	68	510	2.4	2.0	27	186	38	6	12.8	156	11.0	57.6	0.75	1.8
160	101.6	103.5	535	2.8	<1.0	14	84	4	<1	2.6	76	4.4	27.0	0.29	2.5
161	107	113	685	2.8	<1.0	12	138	14	<1	5.2	210	12.4	17.6	0.49	1.2
162	113	116	830	7.0	<1.0	17	43	30	5	3.6	168	4.6	16.8	0.49	<1.0
163	116	122	440	5.0	<1.0	9	111	40	12	4.4	256	8.8	32.6	0.37	<1.0
164	122	133	323	3.4	3.5	7	113	34	10	4.8	240	15.4	11.6	0.39	1.8
165	133	140	515	4.4	1.5	12	84	14	1	3.8	376	31.2	10.8	0.37	<1.0
166	149	150	430	2.4	<1.0	9	94	10	1	6.0	368	31.2	22.4	0.30	<1.0
167	150	160	345	2.0	2.5	12	178	18	1	4.4	192	11.8	8.0	0.30	1.0
168	160	162	760	3.6	3.8	14	150	10	<1	2.6	128	4.6	18.2	0.44	1.9

1/ Sample to extract ratio: 1 to 2.

TABLE 20

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 546

Sample No.	Interval, ft. From	Interval, ft. To	[illegible] Total ppm	Fluoride Total ppm	Lead Total ppm	Mercury Total ppm	Nickel Total ppm	Selenium Available ppm	DTPA Extractable Cadmium ppm	DTPA Extractable Lead ppm	DTPA Extractable Nickel ppm	Emission Spectrographic Scan Semiquantitative Estimates Aluminum ppm	Barium ppm	Silicon ppm	Strontium ppm	[illegible] ppm
151	[illegible]	1[illegible]	[illegible]	270	16	0.040	19	0.04	<0.1	0.2	1.4	30,000	300	>100,000	<500	3,000
152	10	2[illegible]	<2	314	18	0.060	19	0.04	<0.1	[illegible]	[illegible]	30,000	300	>100,000	<500	[illegible]
153	20	30	<2	426	11	0.050	20	0.02	<0.1	4.1	3.1	30,000	300	>100,000	<500	[illegible]
154	30	35	<2	340	16	0.070	19	0.01	<0.1	5.6	3.1	30,000	300	>100,000	<500	[illegible]
155	35	44	<2	210	32	0.130	24	0.01	<0.1	14.6	3.9	30,000	300	>100,000	<500	[illegible]
156	44	47	<2	570	54	0.095	25	0.01	<0.1	16.2	2.8	>100,000	300	>100,000	<500	[illegible]
157	47	53	<2	580	70	0.320	21	0.02	<0.1	27.3	4.2	>100,000	300	>100,000	<500	3,000
158	53	60	5	450	51	0.210	19	0.02	<0.1	21.8	3.3	>100,000	300	>100,000	<500	3,000
159	60	68	5	420	28	0.160	29	0.02	<0.1	12.8	9.0	>100,000	300	>100,000	<500	3,000
160	101.6	103.5	<2	[illegible]	19	0.095	9	0.04	<0.1	16.2	2.2	30,000	300	>100,000	<500	3,000
161	107	113	<2	560	23	0.110	28	0.02	<0.1	15.4	5.9	30,000	300	>100,000	<500	3,000
162	113	116	8	400	19	0.080	26	0.02	<0.1	6.0	5.0	30,000	300	>100,000	<500	3,000
163	116	122	<2	380	14	0.040	14	0.01	<0.1	6.4	2.6	30,000	300	>100,000	<500	3,000
164	122	133	<2	350	15	0.030	13	0.02	<0.1	4.1	2.6	30,000	300	>100,000	<500	3,000
165	133	140	<2	430	19	0.060	21	0.02	<0.1	5.6	3.7	30,000	300	>100,000	<500	3,000
166	140	150	<2	400	17	0.060	19	0.02	<0.1	4.6	3.3	30,000	300	>100,000	<500	3,000
167	150	160	<2	270	13	0.060	13	0.02	<0.1	3.8	2.8	30,000	300	>100,000	<500	3,000
168	160	162	<2	260	27	0.270	25	0.02	<0.1	8.6	10.6	30,000	300	>100,000	<500	3,000

TABLE 3A

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 547

Sample No.	Interval, ft From	To	pH Water (2)	pH 0.01M $CaCl_2$ Solution (2)	Soluble Salts Extract Conductivity millimhos/cm (1)	(3)	Sodium Water Soluble(1)	Sodium NH_4 Acetate Soluble milliequivalents/100 g	Cation Exchange Capacity	Exchangeable Sodium Percentage (4)	Sodium Adsorption Ratio (5)
169	0	10	7.7	7.7	3.90	16.4	0.66	0.72	24.5	0.2	1.0
170	10	20	8.0	7.9	1.70	7.0	0.58	0.65	17.6	0.4	1.3
171	20	30	8.1	7.7	0.60	5.9	0.25	0.42	9.3	1.8	2.1
172	30	36	8.3	7.4	0.60	6.2	0.23	0.42	9.8	1.9	2.2
173	36	41	8.2	7.7	0.60	4.3	0.23	0.40	18.9	0.9	1.5
174	41	51	8.4	7.8	0.52	4.7	0.18	0.40	11.3	1.9	2.2
175	51	56	8.5	8.0	0.45	3.5	0.16	0.43	8.9	3.0	2.9
176	56	62	8.0	7.5	0.70	4.7	0.16	0.27	8.9	1.2	1.7
177	67	71	8.1	7.6	0.35	1.4	0.17	0.36	18.0	1.0	1.5
178	71	75	8.1	7.5	0.60	2.3	0.25	0.44	16.3	1.2	1.7
179	75	85	8.7	7.1	0.80	3.4	0.46	0.79	16.7	2.0	2.2
180	85	90	7.8	7.6	0.55	2.3	0.60	0.84	13.7	1.8	2.1
181	90	95	8.0	7.5	0.67	3.0	0.67	0.78	9.3	1.2	1.7
182	95	103	7.8	7.4	0.70	2.8	1.08	1.30	15.6	1.4	1.8
183	103	108	7.3	7.0	1.10	3.8	1.81	3.17	28.4	4.8	4.3
184	108	111	7.7	7.0	0.90	2.5	1.76	4.40	28.9	9.1	7.6
185	144	146	7.6	7.1	0.45	1.3	1.27	3.82	21.7	11.7	9.8
186	151	154	8.2	7.4	0.55	1.4	0.99	3.73	19.3	14.2	12.1
187	154	159	7.9	7.4	1.10	2.8	1.98	5.64	27.1	13.5	11.4
188	159	165	8.2	7.6	0.90	3.8	1.74	2.43	13.7	5.0	3.7
189	168	178	8.7	7.6	0.65	2.5	1.31	2.69	17.4	7.9	5.7
190	178	184	8.6	7.6	0.80	2.4	1.57	3.73	16.1	13.4	11.3
191	184	188	8.5	7.7	0.70	1.4	1.52	5.13	31.0	11.6	9.8
192	188	193	8.4	7.6	0.80	2.8	1.49	2.73	14.8	8.4	7.1
193	198	203	8.5	7.6	0.70	2.9	1.39	2.56	14.1	8.3	7.0
Comp.	0	111	7.7	7.5	1.60	7.2	0.60	0.80	18.9	1.1	1.7
Comp.	144	203	8.5	7.8	0.80	2.6	1.63	2.95	18.9	7.0	6.0

1/ Sample to extract ratio: 1 to 2.
2/ Sample to extract ratio: 1 to 5.
3/ Estimated conductivity for saturation extract based on 1 to 2 ratio conductivity and 1/3 bar water-holding capacity data.
4/ Calculated from the equation: exchangeable sodium percentage = $\frac{(100)(\text{Na, ammonium acetate soluble} - \text{Na, water soluble})}{(\text{cation exchange capacity})}$.
5/ Calculated by USDA correlation from exchangeable sodium percentage: $ESP = \frac{100(-0.0126 + 0.01475\ SAR)}{1 + (-0.0126 + 0.01475\ SAR)}$.

TABLE 3B

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 547

Sample No.	Interval, ft From	To	Potassium Available ppm	Phosphorus $NaHCO_3$ Soluble ppm	Nitrate ppm	Ammonium ppm	Sulfate Water Soluble ppm (1)	Calcium Water Soluble ppm (1)	Magnesium Water Soluble ppm (1)	DTPA Extractable Cu ppm	Fe ppm	Mn ppm	Zn ppm	Molybdenum Anion Exchangeable ppm	Boron Water Soluble ppm
169	0	10	180	7.4	3.0	8	1288	1200	500	2.4	133	24.0	4.4	0.38	<1.0
170	10	20	300	1.6	5.0	8	488	412	208	1.6	114	30.8	1.6	0.22	1.1
171	20	30	245	1.0	<1.0	5	134	100	64	1.6	146	48.8	4.4	0.21	<1.0
172	30	36	270	6.0	2.8	7	116	68	58	1.2	168	33.6	1.6	0.30	<1.0
173	36	41	267	8.0	2.3	6	165	60	84	1.6	128	36.4	60.0	0.34	<1.0
174	41	51	265	2.0	3.3	11	113	68	64	1.2	126	36.8	17.2	0.20	<1.0
175	51	56	245	1.6	8.3	19	87	56	53	4.0	92	14.6	2.0	0.22	<1.0
176	56	62	200	4.4	5.0	5	186	142	94	0.8	106	15.6	3.6	0.24	1.3
177	67	71	475	2.4	5.5	19	29	54	26	4.8	172	7.2	16.0	0.24	<1.0
178	71	75	450	13.8	2.3	14	130	128	62	6.0	188	14.4	40.0	0.43	<1.0
179	75	85	375	3.4	3.8	12	171	196	74	4.8	188	18.0	41.2	0.21	1.3
180	85	90	395	3.0	7.0	9	108	80	26	4.4	210	20.8	15.4	0.20	<1.0
181	90	93	380	2.2	5.5	9	154	118	32	3.2	174	15.6	12.0	0.26	<1.0
182	93	103	470	1.6	<1.0	9	142	80	20	4.8	364	38.4	40.0	0.41	1.7
183	103	108	585	1.6	5.5	12	165	56	10	6.2	190	16.0	30.6	0.76	1.5
184	108	111	660	6.4	1.3	16	194	18	4	16.4	118	8.4	38.8	0.57	1.4
185	144	146	555	2.0	4.5	7	200	6	<1	10.2	60	4.8	6.4	0.30	5.8
186	151	154	620	2.0	4.5	14	186	6	<1	9.2	160	2.4	22.2	0.60	2.3
187	154	159	630	2.0	2.3	12	178	72	1	8.0	132	5.6	59.6	0.69	2.5
188	159	168	575	1.6	<1.0	9	178	44	12	5.6	288	17.2	52.8	0.54	1.2
189	168	178	485	2.8	4.8	9	82	12	1	6.2	312	25.2	16.0	0.31	<1.0
190	178	184	585	3.6	3.3	10	100	12	1	13.6	232	24.0	66.4	0.61	<1.0
191	184	188	725	2.0	5.8	20	97	16	4	10.2	292	34.0	22.4	0.29	1.2
192	188	198	460	2.2	11.5	11	134	16	4	4.8	236	21.6	11.6	0.24	1.0
193	198	203	450	4.4	4.0	6	98	18	1	4.0	116	10.4	14.4	0.36	<1.0

1/ Sample to extract ratio: 1 to 2.

8.3 K ave

TABLE 30

Chemical Analyses of Overburden and Interburden Samples
Drill Hole 547

Sample No.	Interval, ft From	To	Arsenic Total ppm	Cadmium Total ppm	Fluoride Total ppm	Lead Total ppm	Mercury Total ppm	Nickel Total ppm	Selenium Available ppm	DTPA Extractable Cadmium ppm	Lead ppm	Nickel ppm	Emission Spectrographic Scan Semiquantitative Estimates Aluminum ppm	Barium ppm	Silicon ppm	Strontium ppm	Titanium ppm
169	0	10	10	0.20	280	16	0.030	15	0.02	<0.1	4.3	1.7	30,000	300	>100,000	<500	3,000
170	10	20	<2	0.20	390	15	0.030	16	0.02	<0.1	5.0	0.8	30,000	300	>100,000	<500	3,000
171	20	30	<2	0.15	150	8	0.010	16	0.02	<0.1	2.7	1.0	>100,000	300	>100,000	<500	3,000
172	30	36	<2	0.15	280	10	0.015	15	0.02	<0.1	2.4	1.0	>100,000	300	>100,000	<500	3,000
173	36	41	<2	0.20	270	12	0.025	20	0.02	<0.1	3.5	1.0	3,000	300	>100,000	<500	3,000
174	41	51	<2	0.15	160	11	0.020	15	0.02	<0.1	3.0	1.0	30,000	300	>100,000	<500	3,000
175	51	56	<2	0.10	220	9	0.015	11	0.02	<0.1	3.3	1.1	30,000	300	>100,000	<500	3,000
176	56	62	2	0.15	260	9	0.025	14	0.01	<0.1	2.7	1.3	30,000	300	>100,000	<500	3,000
177	67	71	5	0.20	330	11	0.070	18	0.02	<0.1	9.4	1.1	>100,000	300	>100,000	<500	3,000
178	71	75	2	0.30	250	17	0.290	22	0.02	<0.1	8.4	2.1	30,000	300	>100,000	<500	3,000
179	75	85	2	0.20	340	14	0.210	25	0.03	<0.1	4.3	3.7	30,000	300	>100,000	<500	3,000
180	85	90	<2	0.25	210	19	0.120	20	0.03	<0.1	5.2	2.6	30,000	300	>100,000	<500	3,000
181	90	93	<2	0.45	140	52	0.100	23	0.03	<0.1	5.4	3.9	30,000	300	>100,000	<500	3,000
182	93	103	20	0.30	320	32	0.100	22	0.02	<0.1	16.6	3.0	>100,000	300	>100,000	<500	3,000
183	103	108	5	0.35	350	28	0.120	26	0.03	<0.1	26.4	4.4	>100,000	300	>100,000	<500	3,000
184	108	111	<2	0.50	220	20	0.300	30	0.03	<0.1	17.2	6.6	>100,000	300	>100,000	<500	3,000
185	144	146	3	0.35	410	18	0.120	19	0.04	<0.1	17.6	2.3	>100,000	300	>100,000	<500	3,000
186	151	154	10	0.40	290	19	0.140	32	0.04	<0.1	14.1	3.6	>100,000	3,000	>100,000	<500	3,000
187	154	159	10	0.40	350	20	0.140	25	0.03	<0.1	10.2	3.9	>100,000	300	>100,000	<500	3,000
188	159	168	8	0.35	290	15	0.030	23	0.02	<0.1	5.0	2.3	>100,000	3,000	>100,000	<500	3,000
189	168	173	3	0.30	270	15	0.070	23	0.03	<0.1	5.4	2.2	3,000	300	>100,000	<500	3,000
190	178	184	8	1.10	290	45	0.150	29	0.02	<0.1	27.2	4.2	3,000	300	>100,000	<500	3,000
191	184	188	5	0.35	340	19	0.120	32	0.02	<0.1	8.1	4.9	>100,000	300	>100,000	<500	30,000
192	188	198	8	0.25	160	12	0.070	20	0.04	<0.1	3.7	2.3	30,000	300	>100,000	<500	3,000
193	198	203	5	0.25	170	16	0.240	16	0.04	<0.1	6.9	2.1	30,000	300	>100,000	<500	3,000

Appendix III

Biomass Productions, Range Condition, and Recommended Stocking Rates for the Major Communities on the Amended Area

TABLE I

RANGE CONDITION CLASSIFICATION AND RECOMMENDED STOCKING RATES FOR EIGHT PLANT COMMUNITIES PRESENT ON WESTMORELAND RESOURCES 1975 AMENDED MINING PERMIT AREA

Community Type and Transect Number	Date	SCS Range Site[1]	Condition Classification	Recommended Stocking Rate[2]
Poa spp.-*Koeleria cristata* (111-X-V, Transect 301).....	7/17/75	Silty	Good (65)	0.450
Carex spp.-*Koeleria cristata* (111-T-V, Transect 302).....	7/17/75	Silty	Fair (43)	0.300
Andropogon scoparius-Festuca idahoensis (111-N-U, Transect 304).	8/21/75	Sandy	Good (51)	0.450
Poa spp. (111-X, Transect 306).....	8/22/75	Silty	Good (64)	0.450
Artemisia cana-Carex spp.-*Bouteloua curtipendula* (212-T-O, Transect 303).....	7-18-75	Overflow	Fair (28)	0.400
Artemisia cana-Koeleria cristata-Agropyron smithii (212-V-L, Transect 305).....	8/22/75	Sandy	Fair (26)	0.300
Artemisia cana-Rhus trilobata-Carex spp. (212-C-T, Transect 308).....	8/22/75	Silty	Good (52)	0.450
Pinus ponderosa-Rhus trilobata-Agropyron spicatum (351-C-M, Transect 309).....	8/22/75	Thin-hilly	Good (70)	0.375

[1]Follows SCS criteria.
[2]In AUM's/acre (Animal Unit Months/acre).
[3]Poor = 0-24; fair = 25-49; good = 50-74; excellent = 75-100.

TABLE III

SUMMARY OF THE ANNUAL PLANT BIOMASS PRODUCTION FROM EIGHT PLANT COMMUNITIES PRESENT ON WESTMORELAND RESOURCES 1975 AMENDED MINING PERMIT AREA

Community Type and Transect No.	Forage Class	Clipped Wt. (Gms/5M^2)	Prod. Est. (Lbs/Acre)	Total Biomass Prod. (Lbs/Acre)
Poa spp.-*Koeleria cristata* (111-X-V, Transect 307)	Perennial Grass	441.1	787.1	
	Forbs	249.4	444.9	
				1232.0
Carex spp.-*Koeleria cristata* (111-T-V, Transect 302)	Perennial Grass	368.5	657.5	
	Annual Grass	7.4	13.2	
	Forbs	220.8	394.0	
				1064.7
Andropogon scoparius-Festuca idahoensis (111-N-U, Transect 304)	Perennial Grass	330.6	589.9	
	Forbs	229.8	410.0	
	Shrubs	2.2	3.9	
				1003.8
Poa spp. (111-X, Transect 306)	Perennial Grass	461.1	822.7	
	Forbs	164.3	293.2	
				1115.9
Artemisia cana-Carex spp.-*Bouteloua curtipendula* (212-T-O, Transect 303)	Perennial Grass	349.7	624.0	
	Annual Grass	3.5	6.2	
	Forbs	166.8	297.6	
	Shrubs	257.2	458.9	
				1386.7
Artemisia cana-Koeleria cristata-Agropyron smithii (212-V-L, Transect 305)	Perennial Grass	250.5	447.0	
	Annual Grass	23.9	42.6	
	Forbs	91.9	164.0	
	Shrubs	412.9	736.8	
				1390.4
Artemisia cana-Rhus trilobata-Carex spp. (212-C-T, Transect 308)	Perennial Grass	502.0	895.7	
	Annual Grass	5.4	9.6	
	Forbs	96.1	171.5	
	Shrubs	59.7	106.5	
				1183.3
Pinus ponderosa-Rhus trilobata-Agropyron spicatum (351-C-M, Transect 309)	Perennial Grass	222.1	396.3	
	Forbs	43.4	77.4	
	Shrubs	21.6	38.5	
				512.2